AMENDMENTS TO THE SPECIFICATION

Please substitute the following paragraph for the paragraph starting at page 1, line 9 and ending at line 18.

Recently, strong demands have arisen for a higher density and higher integration degree of semiconductor integrated circuits. In addition, to improve the productivity of semiconductor elements, the exposure time is required to be shorter. In lithography, for processing a circuit pattern, an exposure apparatus using, as a light source, far UV light or an excimer laser beam capable of obtaining high illuminance at a short wavelength is generally used for micropatterning and a shorter exposure time.

Please substitute the following paragraph for the paragraph starting at page 1, line 19 and ending at page 2, line 3.

This technique readily activates a gas around the optical elements of an illumination optical system or projection optical system as it is irradiated with light. ~~For this reason, the surfaces of the optical elements are contaminated at high probability.~~ For this reason, there is a high probability of the surfaces of the optical elements becoming contaminated. A method of preventing contamination has been proposed in which the optical elements of an illumination optical system or projection optical system are accommodated in a closed vessel or the like, and the vessel is filled or replaced with clean dry air or an inert gas, thereby preventing contamination of the internal optical elements.

Please substitute the following paragraph for the paragraph starting at page 3, line 17 and ending at line 21.

If a simple fitting or an O-ring with poor sealing properties is used, the gases in the respective spaces mix to change the refractive index of each gas. For this reason, predetermined optical performance may not be obtained.

Please substitute the following paragraph for the paragraph starting at page 4, line 11 and ending at line 27.

In order to solve the above problem and to achieve the above object, according to the present invention, there is provided an exposure apparatus comprising an optical system having a plurality of spaces and a mechanism that fills each of the spaces with a gas, a gas contained at least in one of the plurality of spaces has a refractive index different from that of a gas contained at least in one of the remaining spaces, and a pressure of the gas at least in the one of the plurality of spaces is different from that of the gas at least in the one of the remaining spaces. The apparatus may be such wherein the optical system comprises a plurality of optical elements, a holding member for holding the optical elements, and a vessel for accommodating the optical elements and the holding member, the vessel having the plurality of spaces inside.

Please substitute the following paragraph for the paragraph starting at page 5, line 10 and ending at line 14.

The air space portion of a projection optical system or the like generally has a space sensitive to a change in optical performance (mainly, generation of aberration) due to a change in refractive index of a gas and an insensitive space.

Please substitute the following paragraph for the paragraph starting at page 5, line 15 and ending at line 25.

In consideration of the above situation, a purge system is formed in the optical system to set a high pressure in the optically sensitive space and a low pressure in the insensitive space. With this arrangement, an optical system can be constructed in which a change in refractive index of the optically sensitive space can be suppressed to be low, the entire optical system can be made insensitive to gas leakage between the spaces, i.e., the design value can be perfectly satisfied, and a change in optical performance can be sufficiently reduced.

Please substitute the following paragraph for the paragraph starting at page 7, line 3 and ending at line 22.

The present invention includes a semiconductor device manufacturing method comprising the steps of installing manufacturing apparatuses for performing various processes in a semiconductor manufacturing factory, including one of the above exposure apparatuses, and manufacturing a semiconductor device in a plurality of processes by using the manufacturing apparatuses. The method may further comprise the steps of connecting the manufacturing apparatuses by a local area network, and communicating information about at least one of the manufacturing apparatuses between the local area network and an external network of the semiconductor manufacturing factory. Maintenance information of the manufacturing apparatus can be acquired by data communication by accessing a database provided by a vendor or user of the exposure apparatus via the external network, or production can be managed by data communication via the external network with a semiconductor manufacturing factory other than the semiconductor manufacturing factory.

Please substitute the following paragraph for the paragraph starting at page 7, line 23 and ending at page 8, line 16.

The present invention can also be applied to a semiconductor manufacturing factory comprising manufacturing apparatuses for performing various processes, including the above exposure apparatus, a local area network for connecting the manufacturing apparatuses, and a gateway for allowing the local area network to access an external network of the factory, wherein information about at least one of the manufacturing apparatuses is communicated by connection to the external network. The present invention can also be applied to a maintenance method for an exposure apparatus installed in a semiconductor manufacturing factory, comprising the steps of causing a vendor or user of the exposure apparatus to provide a maintenance database connected to an external network of the semiconductor manufacturing factory, authenticating access from the semiconductor manufacturing factory to the maintenance database via the external network, and transmitting maintenance information accumulated in the maintenance database to the semiconductor manufacturing factory via the external network.

Please substitute the following paragraph for the paragraph starting at page 8, line 17 and ending at page 9, line 1.

The present invention can also be applied to an exposure apparatus comprising a display, a network interface, and a computer for executing network software, wherein maintenance information ~~to the exposure apparatus~~ can be communicated to the exposure apparatus via a computer network. In this case, the network software may be connected to an external network of a factory where the exposure apparatus is installed, provide on the display a user interface for accessing a maintenance database provided by a vendor or user of the exposure

apparatus, and enable one to obtain ~~obtaining~~ information from the database via the external network.

Please substitute the following paragraph for the paragraph starting at page 9, line 7 and ending at line 16.

Other objects and advantages besides those discussed above shall be apparent to those skilled in the art from the description of a preferred embodiment of the invention which follows. In the description, reference is made to accompanying drawings, which form ~~apart~~ a part thereof, and which illustrate an example of the invention. Such an example, however, is not exhaustive of the various embodiments of the invention, and, therefore, reference is made to the claims which follow the description for determining the scope of the invention.

Please substitute the following paragraph for the paragraph starting at page 10, line 4 and ending at line 6.

Fig. 4 is a partial view showing the main part so ~~to as~~ as to explain a purge space sealing method according to the embodiment of the present invention;

Please substitute the following paragraph for the paragraph starting at page 10, line 7 and ending at line 9.

Fig. 5 is a partial view showing the main part so ~~to as~~ as to explain a purge space sealing method according to the embodiment of the present invention;

Please substitute the following paragraph for the paragraph starting at page 10, line 10 and ending at line 12.

A13

Fig. 6 is a partial view showing the main part so ~~to as~~ as to explain a purge space sealing method according to the embodiment of the present invention;

Please substitute the following paragraph for the paragraph starting at page 10, line 13 and ending at line 15.

A14

Fig. 7 is a partial view showing the main part so ~~to as~~ as to explain a purge space sealing method according to the problem of the present invention;

Please substitute the following paragraph for the paragraph starting at page 12, line 21 and ending at page 13, line 2.

A15

~~Aberration~~ An aberration change amount in projection optical system 22 when H_2 (about 0.1%) leaks to He space 51b > an aberration change amount in the projection optical system when He (about 0.1%) leaks to the N_2 space 51a. Hence, to satisfy the ideal performance of the projection optical system, it is preferable to completely eliminate gas exchange (leakage) between the spaces. The gas purge system must be designed at least such that He leaks to the N_2 space 51a.

Please substitute the following paragraph for the paragraph starting at page 14, line 1 and ending at line 8.

A16

Even when a film-like sheet 11 is bonded to the lens barrel 1 and lens holding member 3, as shown in Fig. 6, a seal structure without any adverse influence on the lens optical

performance can be obtained. The film-like sheet 11 may have a screwed structure (not shown) using a press ring or the like from the viewpoint of a detachment operation during the manufacture.

A16 Cont'd

Please substitute the following paragraph for the paragraph starting at page 18, line 27 and ending at page 19, line 10.

The pressure difference set value is optimized on the basis of the sealing properties of the partition portion or the optical sensitivity to gas leakage to each space. If the pressure difference is too large, the refractive index of the gas changes along with the change in pressure, adversely influencing the performance of the projection optical system. Preferably, the low-pressure-side space is set to open air or an equivalent pressure, and the high-pressure-side space is set to generate ~~s~~ a small pressure difference of about +10 to 1,000 Pa.

A17

Please substitute the following paragraph for the paragraph starting at page 19, line 14.

A18

(Embodiment of A Semiconductor Production System)

Please substitute the following paragraph for the paragraph starting at page 19, line ~~11~~ 15 and ending at line 24.

A19

A production system for producing a semiconductor device (e.g., a semiconductor chip such as an IC or an LSI, a liquid crystal panel, a CCD, a thin-film magnetic head, a micromachine, or the like) using an exposure apparatus of the present invention will be exemplified. A trouble remedy or periodic maintenance of a manufacturing apparatus installed in

A19 cont'd a semiconductor manufacturing factory, or maintenance service such as software distribution is performed by using a computer network outside the manufacturing factory.

Please substitute the following paragraph for the paragraph starting at page 19, line 25 and ending at page 20, line 21.

Fig. 9 shows the overall system cut out at a given angle. In Fig. 9, reference numeral 101 denotes a business office of a vendor (e.g., an apparatus supply manufacturer) which provides a semiconductor device manufacturing apparatus. Assumed examples of the

A20 manufacturing apparatus are semiconductor manufacturing apparatuses for performing various processes used in a semiconductor manufacturing factory, such as pre-process apparatuses (e.g., lithography apparatus including an exposure apparatus, a resist processing apparatus, and an etching apparatus, an annealing apparatus, a film formation apparatus, a planarization apparatus, and the like) and post-process apparatuses (e.g., an assembly apparatus, an inspection apparatus, and the like). The business office 101 comprises a host management system 108 for providing a maintenance database for the manufacturing apparatus, a plurality of operation terminal computers 110, and a LAN (Local Area Network) 109, which connects the host management system 108 and computers 110 to construct an intranet. The host management system 108 has a gateway for connecting the LAN 109 to Internet 105 as an external network of the business office, and a security function for limiting external accesses.

Please substitute the following paragraph for the paragraph starting at page 20, line 22 and ending at page 22, line 9.

Reference numerals 102 to 104 denote manufacturing factories of the semiconductor manufacturer as users of manufacturing apparatuses. The manufacturing factories 102 to 104 may belong to different manufacturers or the same manufacturer (e.g., a pre-process factory, a post-process factory, and the like). Each of the factories 102 to 104 is equipped with a plurality of manufacturing apparatuses 106, a LAN (Local Area Network) 111, which connects these apparatuses 106 to construct an intranet, and a host management system 107 serving as a monitoring apparatus for monitoring the operation status of each manufacturing apparatus 106. The host management system 107 in each of the factories 102 to 104 has a gateway for connecting the LAN 111 in the factory to the Internet 105 as an external network of the factory. Each factory can access the host management system 108 of the vendor 101 from the LAN 111 via the Internet 105. The security function of the host management system 108 authorizes access of only a limited user. More specifically, the factory notifies the ~~vender~~ vendor via the Internet 105 of status information (e.g., the symptom of a manufacturing apparatus in trouble) representing the operation status of each manufacturing apparatus 106. The factory can receive, from the ~~vender~~ vendor, response information (e.g., information designating a remedy against the trouble, or remedy software or data) corresponding to the notification, or maintenance information such as the latest software or help information. Data communication between the factories 102 to 104 and the ~~vender~~ vendor 101 and data communication via the LAN 111 in each factory adopt a communication protocol (TCP/IP) generally used in the Internet. Instead of using the Internet as an external network of the factory, a dedicated-line network (e.g., an ISDN) having high security, which inhibits access of a third party, can be adopted. It is also possible that the user constructs a database in addition to one provided by the vendor and sets the database

A21 cont'd on an external network and that the host management system authorizes access to the database from a plurality of user factories.

Please substitute the following paragraph for the paragraph starting at page 22, line 10 and ending at page 23, line 10.

A22 Fig. 10 is a view showing the concept of the overall system of this embodiment that is cut out at a different angle from Fig. 9. In the above example, a plurality of user factories having manufacturing apparatuses and the management system of the manufacturing apparatus vendor are connected via an external network, and production management of each factory or information of at least one manufacturing apparatus is communicated via the external network. In the example of Fig. 10, a factory having manufacturing apparatuses of a plurality of vendors, and the management systems of the vendors for these manufacturing apparatuses are connected via the external network of the factory, and maintenance information of each manufacturing apparatus is communicated. In Fig. 10, reference numeral 201 denotes a manufacturing factory of a manufacturing apparatus user (e.g., a semiconductor device manufacturer) where manufacturing apparatuses for performing various processes, e.g., an exposure apparatus 202, a resist processing apparatus 203, and a film formation apparatus 204 are installed in the manufacturing line of the factory. Fig. 10 shows only one manufacturing factory 201, but a plurality of factories are networked in practice. The respective apparatuses in the factory are connected to a LAN 206 to construct an intranet, and a host management system 205 manages the operation of the manufacturing line.

Please substitute the following paragraph for the paragraph starting at page 23, line 11 and ending at page 24, line 5.

The business offices of vendors (e.g., apparatus supply manufacturers) such as an exposure apparatus manufacturer 210, a resist processing apparatus manufacturer 220, and a film formation apparatus manufacturer 230 comprise host management systems 211, 221, and 231 for executing remote maintenance for the supplied apparatuses. Each host management system has a maintenance database and a gateway for an external network, as described above. The host management system 205 for managing the apparatuses in the manufacturing factory of the user, and the management systems 211, 221, and 231 of the vendors for the respective apparatuses are connected via the Internet or dedicated-line network serving as an external network 200. If ~~a~~ trouble occurs in anyone of a series of manufacturing apparatuses along the manufacturing line in this system, the operation of the manufacturing line stops. This trouble can be quickly solved by remote maintenance from the vendor of the apparatus in trouble via the Internet 200. This can minimize the ~~stop~~ stoppage of the manufacturing line.

Please substitute the following paragraph for the paragraph starting at page 25, line 10 and ending at page 26, line 10.

A semiconductor device manufacturing process using the above-described production system will be explained next. Fig. 12 shows the flow of the whole manufacturing process of the semiconductor device. In step 1 (circuit design), a semiconductor device circuit is designed. In step 2 (mask preparation), a mask having the designed circuit pattern is prepared. In step 3 (wafer manufacture), a wafer is manufactured using a material such as silicon. In step 4 (wafer

process), called a pre-process, an actual circuit is formed on the wafer by lithography using the prepared mask and wafer. Step 5 (assembly), called a post-process, is the step of forming a semiconductor chip by using the wafer manufactured in step 4, and includes an assembly process (dicing and bonding) and a packaging process (chip encapsulation). In step 6 (inspection), inspections such as the operation confirmation test and durability test of the semiconductor device manufactured in step 5 are conducted. After these steps, the semiconductor device is completed and shipped (step 7). The pre-process and post-process are performed in separate dedicated factories, and maintenance is done for each of the factories by the above-described remote maintenance system. Information for production management and apparatus maintenance is communicated between the pre-process factory and the post-process factory via the Internet or dedicated-line network.

Please substitute the following paragraph for the paragraph starting at page 26, line 11 and ending at page 27, line 6.

Fig. 13 shows the detailed flow of the wafer process. In step 11 (oxidation), the wafer surface is oxidized. In step 12 (CVD) , an insulating film is formed on the wafer surface. In step 13 (electrode formation), an electrode is formed on the wafer by vapor deposition. In step 14 (ion implantation), ions are implanted in the wafer. In step 15 (resist processing), a photosensitive agent is applied to the wafer. In step 16 (exposure), the above-mentioned exposure apparatus bakes and exposes the circuit pattern of the mask on the wafer. In step 17 (developing), the exposed wafer is developed. In step 18 (etching), the resist is etched except for the developed resist image. In step 19 (resist removal), an unnecessary resist after etching is removed. These steps are repeated to form multiple circuit patterns on the wafer. A

manufacturing apparatus used in each step undergoes maintenance by the above-described remote maintenance system, which prevents a trouble in advance. Even if a trouble occurs, the manufacturing apparatus can be quickly recovered. The productivity of the semiconductor device can be increased in comparison with the prior art.